First Hit . Fwd Refs

Generate Collection

L8: Entry 18 of 22 File: USPT Oct 17, 1995

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TITLE: GPS receiver

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Brief Summary Text (4):
Each satellite in the constellation transmits two unique direct-sequence spread spectrum messages in phase quadrature on each of two L-band frequencies. The receiver described here only processes the C/A (Coarse/Acquisition) code message on the L1(1575.42 MHz) carrier; but the principles discussed also apply to the P (Precise) code signals on L1 and L2. The direct sequence code signal, which has a frequency of 1,023 Mchips/sec, and a code epoch repetition rate of 1 kHz, modulates the carrier in a binary phase shift keyed (BPSK) manner. This spread signal is further BPSK modulated by a 50 bps data signal. The data includes information which allows the receiver to measure the range between the receiver and the satellite, i.e. data which allows modelling of the spacecraft orbit (ephemeris) and timing information referenced to the precise satellite clock. The receiver clock will always have an offset with respect to the satellite clock, so these range measurements are known as pseudoranges. To perform a position solution, four pseudorange measurements are required--to solve for the four variables x, y, z and the local clock offset. To further enhance the accuracy of the position solution more measurements can be made--over time (several measurements from the same satellites), over a larger satellite set, or over a wider range of satellite signal variables, such as phase and phase rate.

Detailed Description Text (20):
Code value selection simply entails the selection of a satellite code to be used for each channel of the receiver. Each satellite has a code of epoch length 1023 chips, which it repeats at an epoch rate of 1 KHz. In the receiver, each satellite channel generates a replica of the code for the satellite from which it is to receive data. The locally-generated code is multiplied in code mixer 22 by the received satellite signal. If the local code has been delayed such that the codes are matched, the received signal is despread from the 2 MHz spread-spectrum bandwidth to the 100 MHz data bandwidth.

Detailed Description Text (35):
FIG. 3 illustrates the operation of the Kalman filter. The observation vector, Y, consists of the three pseudorange differences and the three phase differences. The state vector is X, and consists of the receiver position, velocity and acceleration in three co-ordinates, and the rate of change of the local clock offset. The "hats" denote estimates or predictions.

Detailed Description Text (37):
The corrections are made by comparing the predicted observation vector, Y, to the observation vector, Y, and processing the prediction error vector that results. The latter is multiplied by the so-called Kalman Gain Matrix, K. The latter is computed via a stochastic modeling technique involving the state covariance matrix, P, the observation error covariance matrix, R, the system noise convariance matrix, Q, and the observation matrix, M. The observation matrix relates the measurement vector to

the state vector.

Detailed Description Text (39):
An observation in the context of this Kalman filter is an input from the pseudorange interpolation algorithm, and an input from the frequency and phase estimators. After the required number of observations have been made, the estimated value of position can be output directly from the predicted state vector to the user. Similarly, the estimates of pseudorange differences to be transmitted to the base station under differential operation can be extracted directly from the predicted observation vector. When pseudorange corrections are available from the base station, these can be utilised to produce the more accurate position by feeding into the filter as illustrated in FIG. 3.